TABLE 2.—*Percentages of verification in halo-rain forecasts for stations, arranged according to latitude and longitude.*

Station.	Longitude.	Latitude.	24-hour.	36-hour.	48-hour.	60-hour.	Average interval.
	° W.	° N.					
Fort Worth, Tex.	97	34	36	48	59	68	24.1
Columbia, Mo.	92	39	24	.....	49	59	.....
Wauseon, Ohio	84	42	58	.....	.....	.....	.....
Columbus, Ohio	83	40	65	75	86	92	26.2
York, N. Y.	78	43	64	.....	83	.....	17.3
Lake Montebello, Md.	76	39	11	.....	67	.....	.....
Blue Hill, Mass.	71	42	.....	68	.....	.....	15.6

While there is an increase of percentages of verification eastward to approximately longitude 80° West, there is also an appreciable falling off as the Atlantic coast is approached. With this in mind, reference to a map of storm tracks (e. g. supplement 1, chart 1) would indicate that the percentages of verification will increase, not so much with latitude or longitude but with the proximity of the observation point to one or more of the storm tracks. The chart showing the weighted, or average cyclonic tracks for January will apply to the months of greatest frequency as well, especially in the northern districts. It will be noted that the eastern stations lie between the paths, or upon the common path of practically all the storms that cross the United States and that Fort Worth, Tex., and Columbia, Mo., are far south of the tracks of the more frequent types. A large percentage of the precipitation occurring over these districts is due to cyclones of either the South Pacific or Texas type, relatively infrequent.

As outlined in previous papers, it has been found at Columbia, Mo., that "22-degree circles are followed by precipitation within 12 to 18 hours, the storm crossing the meridian near the point of observation; (2), when the 45-degree circle is observed, the storm center is usually from 800 to 1,000 miles away and precedes precipitation, if any, by 24 to 36 hours." These deductions were based on the consideration of a relatively small number of observations.

The larger percentage of LOWS affecting the weather at Fort Worth, Tex., pass far to the northward of that station. It was found that quite frequently during the winter months, the center remained so far north as to leave the sky veiled with cirrus and cirro-stratus for from 24 to 48 hours at a time. In cases of this kind, halos occurred slightly in advance of the wind-shift line and were fairly good prognosticators of advancing cold. They were usually followed by "northers" within 24 hours and rarely by precipitation.

At Wauseon, Ohio, a relation was determined between the percentage of verification and the atmospheric pressure. Kirk found that with the pressure below normal and falling, 83 per cent of observed halos were followed by precipitation within 24 hours; that, with the barometer low, but rising, but 53 per cent were followed by rainfall within the prescribed period, and that with the pressure above normal and rising, 63 per cent were followed by fair weather.

A marked relation must, of course, exist between the verification of the halo forecast and the prevailing direction of the wind, the probability of rain increasing with the change to the quarter most often accompanied by precipitation. Thus, at Fort Worth, it was found that 94 of the 99 halos followed by rain or snow within 48 hours were attended or followed by easterly winds and falling pressure. Of the 94 halos so observed, 82, or 87 per cent, were followed by precipitation by the end of the succeeding day. Like conditions appear to exist at Wauseon, Ohio, with southerly winds, and at York, N. Y., with southwest winds. At Columbus, 88 per cent of the halos preceding precipitation by 48 hours were accompanied or followed by southwest winds.

So, with all these facts well in mind, it must be said that the halo indicates the approach of precipitation only in so far as it heralds the approach of the cyclone. To only the extent that the passage of the cyclone affects the weather at the station, is the halo reliable. With knowledge of the condition of the barometer, whether rising or falling, and knowing which direction of the wind most often precedes precipitation, the layman may know what degree of faith to place in the celestial harbingers; but, without this knowledge, he will often have occasion to fall back upon the old adage, "All signs fail in fair weather." The halo is a faithful detector of cyclonic presence; the pressure and wind indicate the cyclone's approach and passage, and a just consideration of these three elements will go far to establish the halo, not as a promise of rain or storm, but as a warning that somewhere far to westward a cyclone is advancing. In this point alone the halo excels.

SELECTED BIBLIOGRAPHY.

The following list of recent papers is selected from those published by the Weather Bureau since 1897:

(1) Types of storms in the United States and their average movements, by Edward H. Bowie and R. Hanson Weightman. Monthly Weather Review Supplement No. 1, Weather Bureau Publication No. 538.
(2) Storms, storm tracks, and weather forecasting, by Frank H. Bigelow, Washington, 1897. 87 p. 8°. (U. S. Weather Bull. 20, W. B. Pub. No. 114.)
(3) Halos and their relation to the weather, by A. H. Palmer. 6 p. Monthly Weather Review, Washington. 42 : 446.
(4) Halos and precipitation at Wauseon, Ohio, by J. M. Kirk. Washington, Monthly Weather Review. 42 : 616.
(5) Halos at Fort Worth, Tex., and their relation to the occurrence of subsequent precipitation, by Howard H. Martin. Washington, Monthly Weather Review. 42 : 67.
(6) Observations of halos and coronas in England, by M. E. T. Gheury. Washington, Monthly Weather Review. 35 : 213–215.
(7) Observations of halos at Columbia, Mo., by George Reeder. Washington, Monthly Weather Review. 35 : 212.
(8) Halo observations at York, N. Y., by Milroy N. Stewart. Washington, Monthly Weather Review. 43 : 441.
(9) Halos and rain or snow, by Martin L. Dobler. Washington, Monthly Weather Review. 35 : 227.

REMARKABLE HALO OBSERVED AT NASHVILLE, TENN., MARCH 16, 1918.

By R. M. WILLIAMSON, Meteorologist.
[Dated: Weather Bureau, Nashville, Tenn., Mar. 20, 1918.]

An interesting and unusual form of solar halo was observed at this station on March 16. It was first seen as a faint fragment of the usual 22-degree circle at 8:45 a. m. (90th meridian time). An hour or more later it appeared as a complete circle, though ill-defined and presenting no unusual features. At 11:45 a. m. the attention of the station force was called to a remarkable series of rings about the sun, and the coloring and arrangement of the circles were so distinct as to attract wide attention. The phenomenon continued, although in changing form, until about 5:30 p. m.

Unfortunately, no instruments were available with which to determine angular distances, but a comparison of this halo with figures outlined in Besson's "Different Forms of Halos" leaves little doubt as to the correctness

of the terms used in the following sketch, which gives roughly the arrangement of the circles and the attending features as observed about noon.[1]

The display was most brilliant from 11:45 a. m. to 12:15 p. m., the prismatic colors being unusually strong

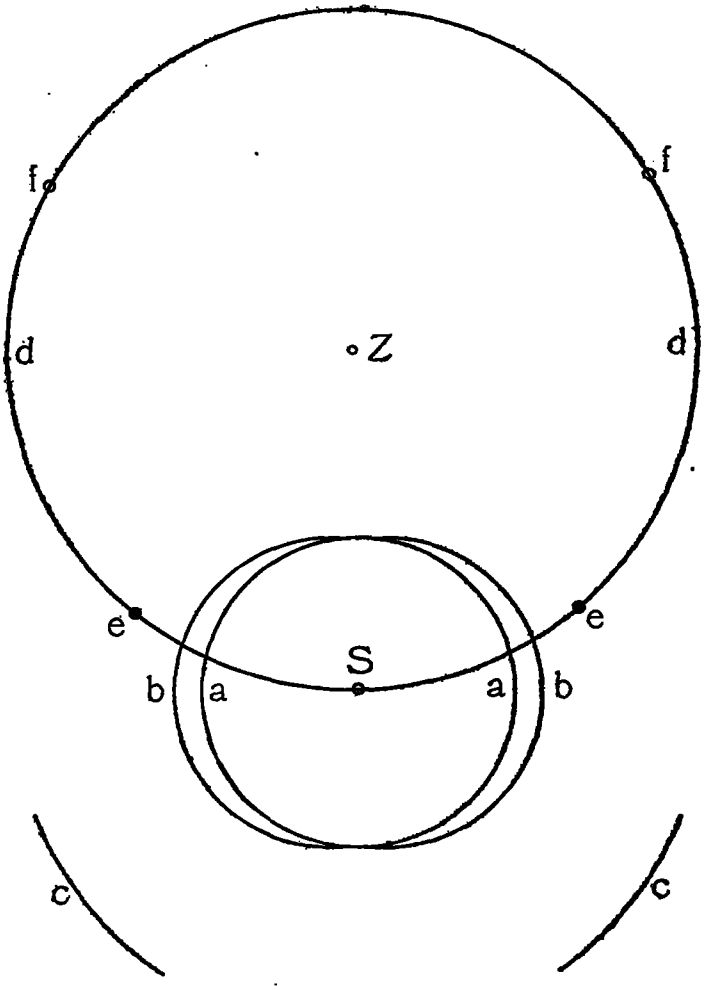

FIGURE 1.—Halo phenomena observed at Nashville, Tenn., March 16, 1918.

Ordinary halo of 22° (*aa*); circumscribed halo (*bb*); arcs of halo 46° (*cc*); parhelic circle (*dd*); ordinary parhelia of 22° (*ee*); paranthelia of 120° (*ff*); sun (*S*); zenith (*Z*).

in the upper and lower quarter arcs of the ordinary and the circumscribed halos, and fairly clear in the remaining portions of the phenomenon, except the parhelic circle, which showed no coloring. There was noted, however, in the parhelic circle at least two spots, or "knots," of white light brighter than the remaining portion of the circle, probably the ordinary paranthelia of 120 degrees (shown in the figure on p. 20 of Besson's pamphlet). The ordinary and cirumscribed halos were distant from each other about three or four degrees at the points of greatest separation on either side of the sun. The fragments (*cc*) of the halo of 46° did not stand out clearly at any time and were not visible after 12:15 p. m. The rings, however, continued complete, though with decreasing brilliancy, until after 2 p. m. By 3 p. m. the sheet of cirro-stratus clouds had become considerably denser and only the ordinary 22-degree halo appeared. At 3:50 p. m. the ordinary parhelia of 22° were again plainly visible, and at this time very close to the 22-degree circle, although when observed about noon they stood well outside (probably 5 degrees from) the cirumscribed halo.

At 4:30 p. m. there was added a still further interesting feature, namely, the circumzenithal arc, distinctly colored, and probably, although this was not positively determined, an arc of the halo of 46° tangent thereto. The latter was not so well defined as the circumzenithal arc, but its determination is believed to have been correct, especially in view of the observation about noon of its two fragmentary arcs. The circumzenithal arc and its accompanying tangent continued for 10 minutes or more. At 5:20 p. m. there was still visible a small upper arc of the ordinary 22-degree halo, and at 5:30 p. m. the phenomenon had disappeared entirely.

[1] The Besson pamphlet referred to is the 8-vo separate of the translation *Besson, L.* Different forms of halos and their observation, MONTHLY WEATHER REVIEW, Washington, July, 1914, 42: 436-446.

SOLAR HALO PHENOMENA OBSERVED MARCH 16, 1918, AT BANNERS ELK, N. C.

By T. L. LOWE, Local Observer.

(Forwarded by Mr. L. A. Denson, Meteorologist in charge, Raleigh, N. C.)

On March 16, 1918, at Banners Elk, N. C., there occurred one of the most peculiar celestial phenomena ever observed here. The thermometer registered 18°F. above zero. At about 8 a. m. there was a haze in the sky and there appeared a complete circle of luminous

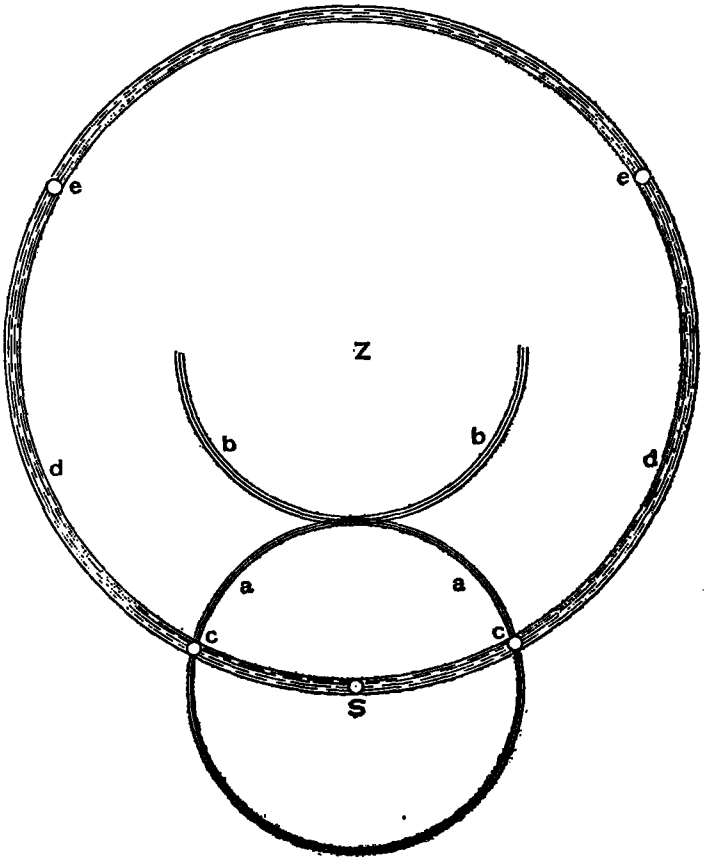

FIGURE 1.—Solar halo phenomena observed March 16, 1918, at Banners Elk, N. C.

aa, 22-degree solar halo; *bb*, upper tangent arc of 22-degree halo; *cc*, parhelia of 22°; *dd*, parhelic circle; *ee*, paranthelia of 120°; *S*, Sun; *Z*, zenith.

light around the sun with two distinct mock suns on either side, as shown in the diagram (fig. 1). Above this circle and tangent to it was a semicircle, and all around